

CLASS 388, ELECTRICITY: MOTOR CONTROL SYSTEMS

SECTION I - CLASS DEFINITION

STATEMENT OF CLASS SUBJECT MATTER

This class and Class 318, Electricity: Motive Power Systems are the generic loci for systems of electrical control of electric motors. See Lines With Other Classes, below, for a further explanation of this line.

Note: This class is being developed in stages from old Class 318, Electricity: Motive Power Systems. As other sections of Class 318 are reclassified, they will be added hereto.

TYPES OF MOTORS

Note: At the present stage of development of this class, only the following types of motor are included.

1. Direct Current (DC) Commutating Motor: An electric motor designed to operate on direct current and having a commutator electrically connected to a winding of the motor.

MODES OF MOTOR CONTROL

Note: At the present stage of development of this class, only the following modes of motor control are included.

1. Acceleration Control: Controlling the rate of change of speed of an electric motor either (a) from zero speed to some running speed, or vice versa, or (b) from one running speed to another running speed by variation of the electric power input to the motor. Acceleration control includes deceleration control.

2. Deceleration Control: Controlling the rate of change of speed of an electric motor from a first running speed to a second (lower) running speed, including zero speed, by variation of the electric power input to the motor.

3. Running Speed Control: Controlling an electric motor so as to maintain a particular substantially constant running speed.

CLASS ORGANIZATION AND SEARCH PHILOSOPHY

This class has been structured according to a new classification philosophy known as "Concept Capture Classification" (CCC or 3C). This type of classification

facilitates a new computer-based search method while continuing to support all traditional uses of the classification of patents.

Organizational Structure - The class consists of two complementary classification schedules:

1. A hierarchical schedule of subclasses (numbered from 800 to 860). The hierarchy of these subclasses follows all the rules that apply throughout the Manual of Classification. These subclasses are designed to accommodate, in general, the claimed subject matter in the patents. They differ from subclasses elsewhere in the Manual only in that they are somewhat broader and tend to contain fewer disclosure-based cross-reference copies.

2. A "term list," or schedule of Art Collections. This list is an indexing scheme with little hierarchy. These Art Collections are much like other Art Collections throughout the Manual of Classification except that care has been taken to place copies of each patent in Class 388 into each and every Art Collection for which that patent has a significant disclosure. In other words, the "concepts" disclosed in each patent are "captured" for later reference by placing cross reference copies into all the appropriate art collections, thus the name "Concept Capture Classification."

METHOD OF CLASSIFYING NEWLY ISSUED PATENTS

When a new patent is issued in this class, copies should be placed in all appropriate subclasses of the hierarchical schedule as required by the claims. Further copies should be placed in all appropriate (according to disclosure) art collections in order to capture as much information about the patent as possible for future reference. Although cross references based on the disclosure but not the claims may be placed in the regular subclasses, they should be limited as much as possible to the Art Collections.

SUGGESTED SEARCH STRATEGIES

A traditional search of paper copies may be conducted in the same way as with any other class by selecting subclasses from among those numbered subclasses 800-860, and then looking at each patent in each subclass chosen. This approach may also be used on the "Automated Patent System" (APS) with limitation that only those patents more recent than 1975 are available for text display.

A computer-aided search (or “CCC Search”) may be conducted by searching a collection of subclasses and Art Collections combined using the logical operations of the APS or of the “Classification and Search Support Information System” (CASSIS), CD-ROM version. In either of these systems one would compose a search statement that says, for example, “Give me a list of all patents which are in subclass 811 and art collections (902 and 903 and 917).” To appear on the output list a patent would have to have a copy in all of the subclasses chosen. A somewhat less restrictive search statement might be used, as for example, “Give me a list of all patents which are in subclass 811 and art collections (902 or 903 or 917).”

In each of the search examples (811 and 902 and 903 and 917; and 811 and 902 or 903 or 917) note that the art collections (902, 903 and 917) are used as tools to search the subclass (811). In other words the subclass 811 is the true location of the patent but it resides there with many other patents of the same proximate function. Traditionally, it has been necessary to look at all patents in subclass 811 during a search and make judgments “on the spot” as to their relevancy to a given search condition. With a CCC search, one enters the search condition into the computer in terms of which art collections are chosen, then the computer selects from subclass 811 only those which are relevant to the given conditions. In this way the searcher, hopefully, views fewer patents which are more relevant to his search and he does not miss “hidden” or “implicit” disclosures.

An experimental computer-aided “CCC search” with specialized output is available on the CASSIS CD-ROM machines in many Patent Depository Libraries. These machines are programmed to give a search of up to three subclasses using up to six art collections. e.g., Search (811 or 819 or 831) and (902 or 903 or ... or 937)

Note. This search treats the three subclasses as separate searches and prints the lists of “hits” separately for each. The output is in the form of a graph with patent number as vertical axis and art collections as horizontal axis. For each patent found as a “hit” a line is printed giving the patent number, which subclass it is in, and which art collections (of those entered) it is in. If the patent is in one subclass and one art collection (only) it is considered a “2-way hit”, if it is in one (or more) subclass(es) and all six art collections it is considered a “7-way hit” and is flagged accordingly. Obviously, “7-way” hits share more features with the search statement than “2-way” hits. This special output offers the important advantage

of not only identifying relevant patents, but of indicating just what is relevant about each included patent.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

Where an electric motor control system is claimed in combination with a load device and the load device is claimed either (1) in general terms only (e.g., “load device”, “variable load”, “means actuated by motor”, etc.) or (2) in specific terms, but by name only (e.g., “vehicle”, “rolling mill”, “gearing”, etc.), classification is in this class (388) or in Class 318, Electricity: Motive Power Systems.

Where significant structure of a load device is claimed in combination with a motor control system, classification is with the load device.

Examples of classes which provide for the combination of significant load device structure and motor control include: Class 62, Refrigeration; Class 180, Motor Vehicles; Class 187, Elevator, Industrial Lift Truck, or Stationary Lift for Vehicle; Class 219, Electric Heating; Class 244, Aeronautics; Class 250, Radiant Energy; Class 290, Prime-Mover Dynamo Plants; Class 322, Electricity: Single Generator Systems; Class 360, Dynamic Magnetic Information Storage or Retrieval; Class 414, Material or Article Handling; and Class 417, Pumps.

SECTION III - REFERENCES TO OTHER CLASSES

SEE OR SEARCH CLASS:

- 62, Refrigeration, appropriate subclasses, particularly subclasses 228.1+ for motor driven refrigerant compressors.
- 180, Motor Vehicles, appropriate subclasses for electric motor driven vehicles or vehicle sub-systems.
- 187, Elevator, Industrial Lift Truck, or Stationary Lift for Vehicle, subclasses 289+ for an elevator with an electric drive motor controlled by means having an electric component.
- 200, Electricity: Circuit Makers and Breakers, appropriate subclasses for generic structure of circuit making and breaking devices.
- 219, Electric Heating, appropriate subclasses for electric heating apparatus including electric motors.

- 236, Automatic Temperature and Humidity Regulation, appropriate subclasses for temperature and humidity regulating systems which include an electric motor, particularly subclasses 74+ for electric motor actuated systems.
- 244, Aeronautics and Astronautics, appropriate subclasses for aeronautical subsystems which include electric motors.
- 250, Radiant Energy, appropriate subclasses for radiant energy responsive apparatus which include motors.
- 290, Prime-Mover Dynamo Plants, subclasses 9+ for prime-mover dynamo plants including electric traction motors; subclasses 10+, 22+, 30, 31, 36+, 38, 46, 47 and 48 for electric motor starters for prime-mover dynamo plants.
- 307, Electrical Transmission or Interconnection Systems, subclasses 401+ for generic saturable reactor systems.
- 310, Electrical Generator or Motor Structure, appropriate subclasses for generic structure of electric motors, particularly subclass 189 for variable length or tapped windings.
- 322, Electricity: Single Generator Systems, electric motor systems are found throughout the class both as driving means for a generator and as a control therefor. See particularly subclass 16 for electric motor driven generator systems having simultaneous control of motor and generator; subclass 39 for electric motor driven generator systems having electric motor control; subclasses 70, 71, 80 and 84 for generator control systems employing electric motor systems therein. See section IV of the class definition of Class 322.
- 323, Electricity: Power Supply or Regulation Systems, subclass 340 for electric motor systems which control transformer tap changing; subclass 364 for electric motor systems controlled impedance selection systems; and appropriate subclasses throughout the class for electric motor actuated or controlled phase control systems.
- 327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 518+ for miscellaneous control systems.
- 331, Oscillators, appropriate subclasses for oscillators, per se, particularly subclasses 1+ for tunable oscillators of the automatic frequency stabilizing type; and subclasses 48, 90 and 177+ for oscillators having means for setting or controlling the frequency of a generated wave of the oscillator by varying a frequency determining element of the oscillator.
- 332, Modulators, subclasses 106+ for generic pulse modulation control systems.
- 360, Dynamic Magnetic Information Storage or Retrieval, appropriate subclasses for control of motors used in dynamic recording apparatus.
- 361, Electricity: Electrical Systems and Devices, subclasses 23+ for motor protection circuits which cause shut-down of the motor when predetermined conditions are met or exceeded; and subclasses 139+ for control circuits for relays and other electromagnetic-magnetic devices.
- 363, Electric Power Conversion Systems, subclasses 157+ for frequency conversion systems for controlling the frequency applied to load circuits in general.
- 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, subclasses 27+ for generic pulse counting systems.
- 414, Material of Article Handling, appropriate subclasses for control of motors used in materials or article handling apparatus.
- 417, Pumps, subclasses 1+ for condition responsive control of a pump driver motor.
- 700, Data Processing: Generic Control Systems or Specific Applications, subclasses 1 through 89 for generic digital data processing control systems.

SECTION IV - GLOSSARY

ANALOG

Of or pertaining to the general class of devices or circuits in which the output varies as a continuous function of the input (cf., "digital" below).

ANALOG CONTROL

A control circuit utilizing analog, as opposed to digital, signals.

ARMATURE

The moving element in an electromechanical device such as the rotating part of a generator or motor, the movable part of a relay, or the spring mounted portion of a bell or buzzer.

BRUSH

A piece of conductive material, usually carbon or graphite, which rides on the commutator of a motor and forms

the electrical connection between the motor and a power source.

CLOSED LOOP CONTROL

A method of control in which the power input of a motor is adjusted by a control circuit which compares a reference signal with a feedback signal proportional to an output parameter (e.g., speed) of the motor to modify the power input of the motor so as to achieve or maintain some desired operating condition of the motor (e.g., constant running speed).

COMMUTATOR

The part of a motor armature to which the armature windings are connected. It consists of a set of conductors arranged about the rotation axis of the armature and insulated from the axis and from one another. A set of stationary contacts, called “brushes” ride on the outer face of the conductors and thereby connect the armature windings to a power source.

COUNTER EMF

A voltage developed in an inductive circuit (e.g., in an armature winding) by an alternating or pulsating current. The polarity of this voltage is at every instant opposite that of the applied voltage.

DIGITAL

Of or pertaining to the general class of devices or circuits in which the output varies in discrete steps (cf., “analog” above).

DIGITAL CONTROL

A control circuit utilizing digital, as opposed to analog, signals.

ELECTRIC MOTOR

A machine which transforms electrical energy into mechanical work. Note: For a description of each of the several types of electric motor, see section IA above.

FEEDBACK

The return of energy from the output of a motor to the input for the purpose of controlling the input so as to achieve or maintain a desired output condition.

FIELD WINDING

A coil of insulated wire which produces a magnetic field in the space occupied by the motor armature.

LOAD

That device, or system, which is the recipient of the mechanical work output of an electric motor.

MICROPROCESSOR

A circuit which can be programmed with stored instructions to perform a variety of functions, which functions may include, for example, one or more modes of motor control.

MOTOR CONTROL

A system or device (usually an electrical circuit) which causes one or more of the operating parameters of a motor to be held constant or to be changed in a predetermined way. Note: For a description of each of the several modes of motor control, see the class definition above.

OPEN LOOP CONTROL

A method of control in which the power input to a motor is varied so as to achieve a desired running condition (e.g., constant running speed) without the use of feedback.

PHASE LOCKED LOOP

A closed loop circuit in which the output signal is compared to a reference signal and any phase difference between the two signals is used to adjust the output signal to “lock” it to the phase of the reference signal.

SUBCLASSES

800 CLOSED LOOP SPEED CONTROL SYSTEM FOR DC MOTOR WITH COMMUTATOR:

This subclass is indented under the class definition. Subject matter wherein a signal proportional to the running speed of a DC commutating motor (i.e., a feedback signal) is used to regulate the input to the motor to maintain a constant running speed.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

825+, for open loop (i.e., without feedback) speed control systems for commutating DC motors.

SEE OR SEARCH CLASS:

318, Electricity: Motive Power Systems, subclasses 59+ and 66+ for speed control in plural, diverse, or diversely controlled DC motors; subclasses 772+, 799+ and 823+ for speed control in AC Induction motors; and subclasses 138 and 254 for speed control in brushless (i.e., noncommutating) motors.

801 Field control, or field and armature control, by digital or combined analog and digital circuitry:

This subclass is indented under subclass 800. Subject matter in which regulation of the running speed of the motor is effected by digital, or a combination of analog and digital, circuitry which controls the energizing of, (1) a field winding of the motor, or (2) both a field winding and an armature winding.

(1) Note. See the Glossary in the class definition for the terms “digital” and “analog”.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

803+, for analog (only) closed loop running speed control of field windings or of both field and armature windings.

809+, for digital or combined analog and digital closed loop running speed control systems which control an armature winding only.

803 Field control, or field and armature control, by analog (only) circuitry:

This subclass is indented under subclass 800. Subject matter in which regulation of the running speed of the motor is effected by analog circuitry which controls the energizing of, (1) a field winding of the motor, or (2) both a field winding and an armature winding.

(1) Note. See the Glossary in the class definition for “analog.”

SEE OR SEARCH THIS CLASS, SUB-CLASS:

816+, for analog closed loop running speed control systems which control an armature winding only.

804 By pulse width or duty cycle modification:

This subclass is indented under subclass 803. Subject matter wherein energy is applied to the motor in the form of a series of pulses and the running speed of the motor is controlled by varying the width of the pulses or by periodic interruption of the pulses.

805 By phase or frequency modification:

This subclass is indented under subclass 803. Subject matter wherein the control circuit functions by determining the phase or frequency relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

806 By voltage or current modification:

This subclass is indented under subclass 803. Subject matter wherein the control circuit functions by determining the voltage or current relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

807 With variable impedance:

This subclass is indented under subclass 806. Subject matter wherein the control circuit includes a variable impedance device.

(1) Note. Variable impedance devices include potentiometers, variable inductors, and variable capacitors.

808 By selection of windings:

This subclass is indented under subclass 803. Subject matter wherein running speed is controlled by selecting the windings of the motor field, or armature, or both, which receive energization.

809 Armature control by digital or combined analog and digital circuitry:

This subclass is indented under subclass 800. Subject matter in which regulation of the running speed of the motor is effected by digital, or a combination of analog and digital, cir-

cuitry which controls the energization of an armature winding only.

- (1) Note. See the Glossary in the class definition the terms “digital” and “analog”.

811 By pulse width or duty cycle modification:

This subclass is indented under subclass 809. Subject matter wherein energy is applied to the motor in the form of a series of pulses and the running speed of the motor is controlled by varying the width of the pulses or by periodic interruption of the pulses.

812 By phase and frequency modification:

This subclass is indented under subclass 809. Subject matter wherein the control circuit functions by determining both the phase and the frequency relationships between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

813 By phase modification:

This subclass is indented under subclass 809. Subject matter wherein the control circuit functions by determining the phase relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

814 By frequency modification:

This subclass is indented under subclass 809. Subject matter wherein the control circuit functions by determining the frequency relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

815 By voltage or current modification:

This subclass is indented under subclass 809. Subject matter wherein the control circuit functions by determining the voltage or current relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

816 Analog armature control:

This subclass is indented under subclass 800. Subject matter in which regulation of the running speed of the motor is effected by analog (only) circuitry which controls the energization of an armature winding only.

SEE OR SEARCH THIS CLASS, SUBCLASS:

803+, for analog closed loop running speed control systems which control a field winding or both a field and an armature winding.

819 By pulse width or duty cycle modification:

This subclass is indented under subclass 816. Subject matter wherein energy is applied to the motor in the form of a series of pulses and the running speed of the motor is controlled by varying the width of the pulses or by periodic interruption of the pulses.

820 By phase of frequency modification:

This subclass is indented under subclass 816. Subject matter wherein the control circuit functions by determining the phase or frequency relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

821 By voltage and current modification:

This subclass is indented under subclass 816. Subject matter wherein the control circuit functions by determining both the voltage and current relationships between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

822 By voltage modification:

This subclass is indented under subclass 816. Subject matter wherein the control circuit functions by determining the voltage relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

823 By current modification:

This subclass is indented under subclass 816. Subject matter wherein the control circuit functions by determining the current relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

824 By variable impedance (e.g., potentiometer):

This subclass is indented under subclass 816. Subject matter wherein the control circuit includes a variable impedance device.

- (1) Note. Variable impedance devices include potentiometers, variable inductors, and variable capacitors.
- 825 OPEN LOOP SPEED CONTROL SYSTEM FOR DC MOTOR WITH COMMUTATOR:**
This subclass is indented under the class definition. Subject matter wherein a derived reference signal is applied to the input circuit of a commutating DC electric motor to regulate the running speed of the motor.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
800+, for closed loop speed control systems for commutating DC motors.
- SEE OR SEARCH CLASS:
318, Electricity: Motive Power Systems, subclasses 59+ and 66+ for speed control in plural, diverse, or diversely controlled DC motors; subclasses 772+, 799+ and 823+ for speed control in AC induction motors; and subclasses 138 and 254 for speed control in brushless (i.e., noncommutating) motors.
- 826 Field control, or field and armature control:**
This subclass is indented under subclass 825. Subject matter in which regulation of the running speed of the motor is effected by circuitry which controls the energization of, (1) a field winding of the motor, or (2) both a field winding and an armature winding.
- (1) Note. In this subclass, and the subclasses indented hereunder, the control circuitry may function in either a digital mode or an analog mode or a combination of digital and analog modes. See the Glossary in the class definition for the terms “digital” and “analog.”
- SEE OR SEARCH THIS CLASS, SUBCLASS:
828+, for digital or combined analog and digital open loop running speed control system which control an armature winding only.
- 830+, for analog (only) open loop running speed control of armature (only) windings.
- 827 With plural selectable speeds (e.g., manual switch):**
This subclass is indented under subclass 826. Subject matter including means for selection of two or more preset speeds.
- 828 Armature control by digital or combined analog and digital circuitry:**
This subclass is indented under subclass 825. Subject matter in which regulation of the running speed of the motor is effected by digital, or a combination of analog and digital, circuitry which controls the energization of an armature winding only.
- (1) Note. See the Glossary in the class definition for the terms “digital” and “analog.”
- 829 By pulse width or duty cycle modification:**
This subclass is indented under subclass 828. Subject matter wherein energy is applied to the motor in the form of a series of pulses and the running speed of the motor is controlled by varying the width of the pulses or by periodic interruption of the pulses.
- 830 Analog armature control:**
This subclass is indented under subclass 825. Subject matter in which the regulation of the running speed of the motor is effected by analog (only) circuitry which controls the energization of an armature winding only.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
826+, for analog open loop running speed control systems which control a field winding or both a field and an armature winding.
- 831 By pulse width or duty cycle modification:**
This subclass is indented under subclass 830. Subject matter wherein energy is applied to the motor in the form of a series of pulses and the running speed of the motor is controlled by varying the width of the pulses or by periodic interruption of the pulses.

- 832 By frequency modification:**
This subclass is indented under subclass 830. Subject matter wherein the control circuit functions by adjusting the frequency of DC power pulses applied to the motor input.
- 833 By voltage or current modification:**
This subclass is indented under subclass 830. Subject matter wherein the control circuitry functions by adjusting the amplitude of the voltage or current which is applied to the input circuit of a motor.
- 834 By selection of windings:**
This subclass is indented under subclass 830. Subject matter wherein running speed is controlled by selecting the windings of the armature which receive energization.
- 835 By control of motor structure:**
This subclass is indented under subclass 830. Subject matter wherein running speed is controlled by altering the structural relationship of motor components.
- 836 Position or number of brushes:**
This subclass is indented under subclass 835. Subject matter wherein the structure is altered by (a) repositioning one or more commutator brushes or, (b) changing the number of brushes in use.
- 837 By periodic mechanical switch:**
This subclass is indented under subclass 830. Subject matter wherein running speed is controlled by means of a mechanical switch which operates repetitiously at a predetermined rate.
- 838 With plural selectable speeds (e.g., with manual switch, potentiometer):**
This subclass is indented under subclass 830. Subject matter including means for selecting two or more speeds.
- (1) Note. Speed selection may be either (1) continuous (e.g., using a potentiometer), or (2) discontinuous (e.g., using a multi-position mechanical switch).
- 839 By selecting impedance:**
This subclass is indented under subclass 838. Subject matter wherein running speed is controlled by insertion of an impedance device and
- provision is made for selecting a device from among several having different impedance values.
- (1) Note. Impedance devices include resistors, capacitors, and inductors.
- 840 Resistive:**
This subclass is indented under subclass 839. Subject matter wherein the impedance device is a resistor.
- 841 Inductive:**
This subclass is indented under subclass 839. Subject matter wherein the impedance device is an inductor.
- 842 CLOSED LOOP ACCELERATION CONTROL SYSTEM FOR DC MOTOR WITH COMMUTATOR:**
This subclass is indented under the class definition. Subject matter wherein a signal proportional to the running speed of a DC commutating motor (i.e., a feedback signal) is used to regulate the input to the motor to control the rate of change of speed (i.e., acceleration of deceleration) or the motor.
- (1) Note. In this subclass, and the subclasses indented hereunder, the control circuitry may function in either a digital mode or an analog mode or a combination of digital and analog modes. See the Glossary in the class definition for “digital” and “analog.”
- SEE OR SEARCH THIS CLASS, SUBCLASS:
848+, for open loop (i.e., without feedback) acceleration control systems for commutating DC motors.
- SEE OR SEARCH CLASS:
318, Electricity: Motive Power Systems, subclass 64 and 90+ for acceleration control in plural, diverse, or diversely controlled DC motors; and subclasses 138 and 254 for acceleration control in brushless (i.e., noncommutating) motors.

- 843 Field control, or field and armature control:**
This subclass is indented under subclass 842. Subject matter in which regulation of the acceleration of the motor is effected by circuitry which controls the energization of, (1) a field winding of the motor, or (2) both a field winding and an armature winding.

SEE OR SEARCH THIS CLASS, SUBCLASS:

844+, for closed loop acceleration control systems which control an armature winding only.

- 844 Armature control:**
This subclass is indented under subclass 842. Subject matter in which regulation of the acceleration of the motor is effected by circuitry which controls the energization of an armature winding only.

- 847 By voltage or current modification:**
This subclass is indented under subclass 844. Subject matter wherein the control circuit functions by determining the voltage or current relationship between a reference signal and a feedback signal and by applying an adjustment, based on this relationship, to the motor input.

- 848 OPEN LOOP ACCELERATION CONTROL SYSTEM FOR DC MOTOR WITH COMMUTATOR:**
This subclass is indented under the class definition. Subject matter wherein a derived reference signal is applied to the input circuit of a commutating DC electric motor to regulate acceleration or deceleration of the motor.

- (1) Note. In this subclass, and the subclasses indented hereunder, the control circuitry may function in either a digital mode or an analog mode or a combination of digital and analog modes. See the Glossary in the class definition for "digital" and "analog."

SEE OR SEARCH THIS CLASS, SUBCLASS:

842+, for closed loop acceleration control systems for commutating DC motors.

SEE OR SEARCH CLASS:

318, Electricity: Motive Power Systems, subclass 64 and 90+ for acceleration control in plural, diverse, or diversely controlled DC motors and subclasses 138 and 254 for acceleration control in brushless (i.e., noncommutating) motors.

- 849 Field control, or field and armature control:**
This subclass is indented under subclass 848. Subject matter in which regulation of the acceleration of the motor is effected by circuitry which controls the energization of, (1) a field winding of the motor, or (2) both a field winding and an armature winding.

SEE OR SEARCH THIS CLASS, SUBCLASS:

853+, for open loop acceleration control systems which control an armature winding only.

- 850 By transformer or inductive device:**
This subclass is indented under subclass 849. Subject matter wherein acceleration of the motor is controlled by a transformer or other inductor.

- 851 By patterned switch:**
This subclass is indented under subclass 849. Subject matter wherein acceleration of the motor is controlled by a mechanical device which makes and breaks the motor circuit according to a predetermined pattern.

- 852 By insertion of resistance:**
This subclass is indented under subclass 849. Subject matter wherein acceleration of the motor is controlled by increasing or decreasing the amount of resistance in the motor circuit.

- 853 Armature control:**
This subclass is indented under subclass 848. Subject matter in which regulation of the acceleration of the motor is effected by circuitry which controls the energization of an armature winding only.

- 854 By voltage or current modification:**
This subclass is indented under subclass 853. Subject matter wherein the control circuitry functions by adjusting the amplitude of the

voltage or current applied to the input circuit of the motor.

855 By selectable or variable impedance:

This subclass is indented under subclass 853. Subject matter wherein the control circuit includes a variable impedance device or a set of fixed impedance devices which are selectable by switches, or other means.

- (1) Note. Variable impedance devices include potentiometers, variable inductors, and variable capacitors.

856 By insertion of resistance or shorting of circuit:

This subclass is indented under subclass 855. Subject matter wherein the impedance device is a variable resistor, or a set of fixed resistors of different values - including zero resistance (short circuit).

857 With relay:

This subclass is indented under subclass 856. Subject matter including a relay.

858 Time delay relay:

This subclass is indented under subclass 857. Subject matter including a time-delayed relay.

859 With patterned switch:

This subclass is indented under subclass 856. Subject matter wherein resistance are inserted by a mechanical device which functions according to a predetermined pattern.

860 Manual:

This subclass is indented under subclass 855. Subject matter wherein the impedance value of the motor circuit is selected or varied manually.

CROSS-REFERENCE ART COLLECTIONS

NOTE: No paper files exist for these art collections. They are to be used for APS searching. An effective way to use them is to cross search an art collection with a range of subclasses in the schedule of this class, (e.g., Use the search statement "S 388820/CCLS AND 388902/CCLS" to find closed loop analog speed control by frequency modification combined with compensation for voltage fluctuations).

900 SPECIFIC SYSTEM OPERATIONAL FEATURE:

This subclass is indented under the class definition. Electronic cross-reference art collection including miscellaneous aspects of motor control.

- (1) Note. This art collection is intended to serve as a repository for art which an examiner wishes to collect as he would do in creating an "unofficial digest". When sufficient art embodying a given creative concept is assembled here, an official art collection will be established for that concept.

901 Sample and hold:

Art collection of systems which periodically sample an output parameter and generate a feedback signal based on the periodic sample.

- (1) Note. Systems which continuously monitor an output parameter, and which generate a continuously varying feedback signal therefrom, are not cross-referenced here.

902 Compensation:

Art collection of systems which apply one or more corrective signals to a motor input drive signal in order to compensate for operational irregularities.

- (1) Note. "Operational irregularities" include, but are not limited to: temperature changes, frequency drift, voltage fluctuations, friction, structural changes.

903 Protective (e.g., voltage or current limit):

Art collection of systems which act to prevent damage to a motor or to circuitry associated with a motor.

904 Stored velocity profile:

Art collection of systems which include means for storing and using a predetermined velocity profile or pattern of velocities and changes of velocity.

905 Armature and field windings connected in series (i.e., series motor):

Art collection of systems which control electric motors wherein the armature and field wind-

- ings of the motor are connected in series relationship.
- 906 Proportional-integral system:**
Art collection of systems with means to correct both instantaneous (i.e., proportional) errors and long term average (i.e., integral) errors.
- 907 SPECIFIC CONTROL CIRCUIT ELEMENT OR DEVICE:**
This subclass is indented under the class definition. Electronic cross-reference art collection including miscellaneous circuit subsystems or devices used in control systems throughout this class.
- (1) Note. This art collection is intended to serve as a repository for art which an examiner wishes to collect as he would do in creating an "unofficial digest". When sufficient art embodying a given creative concept is assembled here, an official art collection will be established for that concept.
- 907.2 Bridge circuit:**
Art collection of systems which include one or more of the several types of circuit known as "bridge" circuits, e.g., "H" type, Wheatstone type, etc.
- 907.5 Computer or microprocessor:**
Art collection of systems which include digital logic circuitry operating under the control of a stored set of instructions, i.e., a program.
- 908 Frequency to voltage converter:**
Art collection of systems which include a circuit element or subsystem whose function is to convert the frequency of an electrical signal to a voltage.
- 909 Monitoring means:**
Art collection of systems with means to monitor one or more parameters and warn of abnormal conditions.
- 910 Operational/differential amplifier:**
Art collection of systems which include a circuit element or subsystem comprised of an operational or differential amplifier.
- 911 Phase locked loop:**
Art collection of systems which include a circuit element or subsystem which exhibits the property of securing and maintaining a given phase relationship between two electrical signals.
- 912 Pulse or frequency counter:**
Art collection of systems which include a circuit element or subsystem which counts electrical pulses or frequencies.
- 913 Saturable reactor, space discharge device, or magnetic amplifier:**
Art collection of systems which include one or more of the devices known as saturable reactors, space discharge devices, or magnetic amplifiers.
- 914 Thyatron or ignitron:**
Subject matter under art collection 913 wherein the device is specifically a thyatron or an ignitron.
- 915 Sawtooth or ramp waveform generator:**
Art collection of systems which include a circuit element whose function is to generate a repetitious wave with linear rising, or falling, slope.
- 916 Threshold circuit:**
Art collection of systems which include circuit elements which conduct only at voltages above a predetermined minimum value.
- 917 Thyristor or SCR:**
Art collection of systems which include a bistable circuit element whose function is to reverse the polarity of an electrical signal.
- 918 Triggered by unijunction transistor:**
Subject matter under art collection 917 in which the operation of the thyristor or SCR is initiated by a signal from a unijunction transistor.
- 919 Triggered by resistor or capacitor:**
Subject matter under art collection 917 in which the operation of the thyristor or SCR is initiated by a signal from a resistor or a capacitor.

- 920 Chopper:**
Subject matter under art collection 917 in which thyristor or SCR is used to periodically interrupt conduction of a current.
- 921 Timer or time delay means:**
Art collection of systems which include a circuit element or subsystem whose function is to measure time intervals or to determine start or stop times for electrical signals.
- 922 Tuned or resonant circuit:**
Art collection of systems which include an oscillating circuit which can be set to oscillate at a predetermined frequency.
- 923 SPECIFIC FEEDBACK CONDITION OR DEVICE:**
This subclass is indented under the class definition. Electronic cross-reference art collection including miscellaneous devices for generating signals responsive to specific conditions at the output of the motor.
- (1) Note. This art collection is intended to serve as a repository for art which an examiner wishes to collect as he would do in creating an "unofficial digest". When sufficient art embodying a given creative concept is assembled here, an official art collection will be established for that concept.
- 924 Centrifugal device (e.g., governor):**
Art collection of systems wherein feedback is provided by a rotary mechanical device which senses the speed of the motor by sensing the position of weights which are subject to centrifugal forces due to the rotation of the motor.
- 925 Including contacts which open and close motor circuit:**
Subject matter under art collection 924 wherein the rotary device includes electrical contacts which function to open or close the motor circuit at different positions of the weights.
- 926 Which controls a vacuum tube or solid-state device in motor circuit:**
Subject matter under art collection 924 wherein a signal from the rotary mechanical device is applied to a vacuum tube, or a solid state device, which is a part of a motor control circuit.
- 927 Which varies resistance of motor circuit:**
Subject matter under art collection 924 wherein the rotary mechanical device varies the amount of resistance in a motor control circuit.
- 928 Which controls position of commutator brushes:**
Subject matter under art collection 924 wherein the rotary mechanical device controls the relative position of motor commutator brushes.
- 928.1 Counter or back EMF (CEMF):**
Art collection of systems in which an opposing voltage, i.e., counter electromotive force or CEMF, induced in an armature winding, by virtue of the armature's motion within the magnetic field of a field winding is used as a feedback signal in controlling a motor.
- 929 Fluid/granular material flow rate, pressure, or level:**
Art collection of systems in which the running speed of a motor is controlled in accordance with a feedback signal which is proportional to the flow rate, the pressure, or the level of a fluid or granular (i.e., particulate) material.
- 930 Load or torque:**
Art collection of systems in which the running speed of a motor is controlled in accordance with a feedback signal which is proportional to a load or counter torque applied at the motor output.
- 931 Electric generator or magnet as auxiliary load:**
Subject matter under art collection 930 wherein the counter torque is applied to the motor output by a magnet, or by driving an electric generator.
- 932 With reverse torque (e.g., braking):**
Subject matter under art collection 930 wherein the torque is applied to the motor output by a mechanical or electromagnetic brake.
- 933 Radiant energy responsive device:**
Art collection of systems wherein a feedback signal is generated by a device which is sensitive to radiant energy.

934 Thermal condition:

Art collection of systems in which the running speed of the motor is controlled in accordance with a signal which is proportional to the temperature of the motor or of another component of the system.

935 SPECIFIC APPLICATION:

This subclass is indented under the class definition. Electronic cross-reference art collection including miscellaneous specific applications of motor controls.

- (1) Note. This art collections is intended to serve as a repository for art which an examiner wishes to collect as he would do in creating an “unofficial digest”. When sufficient art embodying a given creative concept is assembled here, an official art collection will be established for that concept.

936 Food preparation equipment:

Art collection of systems of motor control applied in the context of a tool for the preparation of food (e.g., electric mixer, food processor, blender, etc.).

937 Hand tool:

Art collection of systems of motor control applied in the context of a portable tool (e.g., electric drill, screwdriver, saw, etc.).

END